

# **The State of Animal Feeding Operations in Region 5**

November, 1999

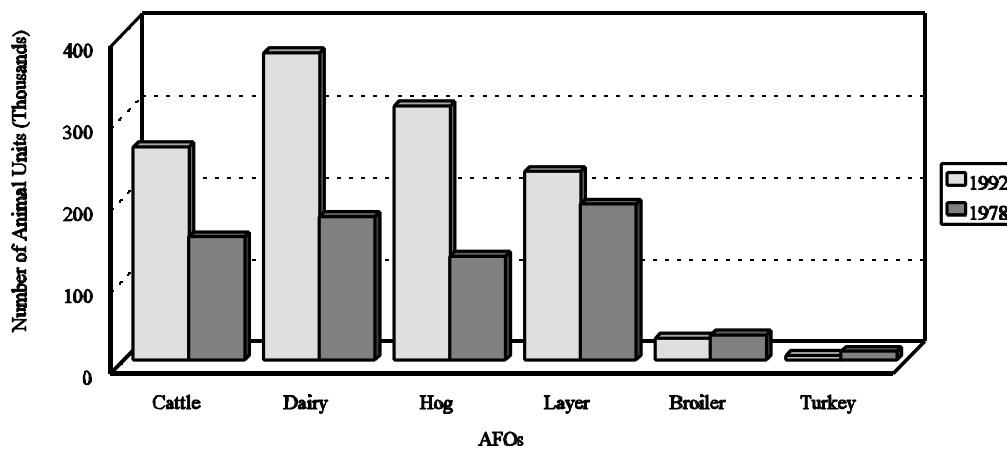
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## The State of AFOs in Region 5

### Introduction

The changing face of animal agriculture in the United States over the past decade has prompted the need for new methods to assess and reduce the impacts of animal feeding operations (AFOs) on surface water quality. The number of AFOs are decreasing across the country (Figure 1). While there are fewer farms, the amount of animal units nationally increased by 4.5 million between 1987 and 1992. This trend has led to fewer and larger farms.<sup>1</sup> Despite this information, however, the universe of AFOs in Region 5 is not clearly understood. The purpose of this report is to gather information on the extent of data available about AFOs regionally and nationally.

**Figure 1. Increase in Farm Size by Operation<sup>5</sup>**



An AFO is “a lot or facility...where the following conditions are met: (i) animals...have been, or will be stabled, or confined and fed or maintained for a total of 45 days or more in any 12-month period, and (ii) crops, vegetation forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility” [40 CFR 122.23 (b)(1)].

An AFO is defined as a concentrated animal feeding operation (CAFO) if the following conditions are met:

- The facility maintains animals in confinement for 45 days or more (the 45 days do not have to be consecutive) in any 12-month period (does not have to follow the calendar year).
- The area of confinement does not sustain vegetation.
- The facility falls into one of the following size-class categories:
  - The facility houses 1,000 or more animal units, or
  - The facility houses between 301 and 999 animal units, **AND** a body of water passes through the confinement area **OR** the facility discharges via a man-made device.
- Utilizes a continuous overflow watering or liquid manure handling (e.g. egg-laying or broiler operation) [40 CFR Appendix B].

In the nation, AFOs are an important part of the economy producing 98.8 billion dollars annually in farm revenue. Animal agriculture is critical in providing a food supply to the American public and contributes to the viability of many rural communities.<sup>2</sup>

Manure is the primary source of pollution from AFOs.<sup>3</sup> When used properly as fertilizer, it is a useful resource. However, animal manure can cause serious water pollution problems when it is improperly disposed of or leached. Pollution also arises from animal carcasses, process waters, feed, bedding, eroded soil, and emissions from confinement buildings. Animal manure is much more abundant than human waste. It is estimated that in 1992, approximately 133 million tons of animal manure was produced, compared to 10 million dry tons of human sanitary wastes. Sources of manure pollution include direct discharges, open feedlots, pastures, treatment and storage lagoons, manure stockpiles, and land application fields. Oxygen-demanding substances, ammonia, nutrients (particularly nitrogen and phosphorus), solids, pathogens, and odorous compounds are the pollutants most commonly associated with manure. Manure is also a source of salts and trace metals, and to a lesser extent, antibiotics, pesticides, and hormones.<sup>3</sup>

The United States Environmental Protection Agency (US EPA) and the United States Department of Agriculture (USDA) created the *Unified National Strategy for Animal Feeding Operations* in response to the risk that animal agriculture has on surface water. To reduce water quality impacts from large-scale operations, CAFOs, the strategy outlines the need to issue National Pollutant Discharge Elimination System (NPDES) general permits to most CAFOs with 1,000 or more animal units by September 2000, identify the population of CAFOs by 2001, and issue permits

to CAFOs with less than 1,000 animal units by 2002. The strategy also describes the expectation that all AFOs will develop and implement a comprehensive nutrient management plan by 2009.<sup>4</sup>

## National

Agricultural activities including animal feeding operations (AFOs) are a significant source of water pollution in the United States. Based on data collected from the *National Water Quality Report to Congress, 1998 draft*, agriculture is the leading source of pollutants causing impairment to assessed rivers/streams and lakes\* (Table 1). Twenty-eight states and tribes reported specific types of agricultural activities that caused impairment to rivers and streams. These states and tribes reported crop production as the primary source of impairment caused by agriculture (Table 2).<sup>6</sup> Runoff from cropland may contain nutrients and soil particles that occur naturally. Runoff can also contain pesticides, biosolids, chemical fertilizers, or animal manure. Often, the source of impairment is unknown due to the difficulty in pinpointing the location and transport of pollutants.

**Table 1. Leading causes of impairments to rivers/streams and lakes\*<sup>6</sup>**

Rank	Rivers/Streams	Lakes
1	Agriculture (59%)	Agriculture (31%)
2	Hydromodification (20%)	Hydromodification (15%)
3	Urban Runoff/Storm Sewers (11%)	Urban Runoff/Storm Sewers (12%)
4	Municipal Point Sources (10%)	Municipal Point Sources (11%)
5	Resource Extraction (9%)	Atmospheric Deposition (6%)

*1998 Water Quality Inventory Report to Congress*

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\* The assessed or surveyed water data reported in the *National Water Quality Report to Congress* are a subset of the Nation's total waters. The summary information derived from these surveyed waters may not represent general conditions in the Nation's total waters because many states, tribes, and other jurisdictions often focus on major waters with suspected problems in order to direct resources to areas that could pose the greatest risk. None of the data reported in the *National Water Quality Report to Congress* predict the health of the unassessed waters.

**Table 2. The specific types of agriculture activities that caused impairment to the 170,750 river/stream miles polluted by agriculture in 28 states and tribes.\*<sup>6</sup>**

	Miles Impaired	Percentage of Miles Impaired by Agriculture
Nonirrigated Crop Production	46,484	27
Irrigated Crop Production	31,156	18
Animal Feeding Operations	27,751	16
Range Grazing	19,469	11
Pasture Grazing	10,597	6

*1998 Water Quality Inventory Report to Congress*

AFOs account for 16 percent or 27,751 miles of the 170,750 impaired river/stream miles caused by agriculture. States identified AFOs as the third most reported source of impairment from agriculture.<sup>6</sup> According to the *National Water Quality Report to Congress, 1998 draft*, the primary pollutants to rivers/streams are also associated with AFOs\* (Table 3). Elevated concentrations of the pollutants from AFOs can be linked with drinking water contamination, risk of infection to those who swim in surface waters, eutrophication, depressed dissolved oxygen concentrations, and toxicity to aquatic life due to ammonia.

**Table 3. Five Leading Pollutants Causing Water Quality Impairment in the U.S. and the total percent of problem attributed by pollutant to the impaired waters.\*<sup>6</sup>**

Rank	Rivers/Streams	Lakes
1	Siltation (38%)	Nutrients (44%)
2	Pathogens (36%)	Metals (27%)
3	Nutrients (29%)	Siltation (15%)
4	Oxygen-Depleting Substances (23%)	Oxygen-Depleting Substances (14%)
5	Metals (21%)	Suspended Solids (10%)

*1998 Water Quality Inventory Report to Congress*

Numbers add up to more than 100% due to multiple causes of impairment

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The USDA's 1997 Census of Agriculture accounted for 1,009,487 establishments that produce livestock based on the North American Industrial Classification System Codes (NAICSC). Of these establishments, 78 percent are engaged in cattle ranching and farming (Figure 2). There are approximately 450,000 AFOs in the United States. Together, these livestock establishments occupy 530 million acres of land. Table 4 shows the top ranking states in livestock and poultry production in the United States, as well as the rankings of Region 5 states.

**Table 4. Top Ranking States in the Livestock and Poultry Industries  
(Region 5 states in italics)**

	<b>Hogs and Pigs</b>	<b>Beef Cows</b>	<b>Milk Cows</b>
<b>1</b>	Iowa	Texas	<i>Wisconsin</i>
<b>2</b>	North Carolina	Missouri	California
<b>3</b>	<i>Minnesota</i>	Oklahoma	New York
<b>4</b>	<i>Illinois</i>	Nebraska	Pennsylvania
<b>5</b>	<i>Indiana</i>	South Dakota	<i>Minnesota</i>
<b>7</b>			<i>Michigan</i>
<b>9</b>	<i>Ohio</i>		<i>Ohio</i>

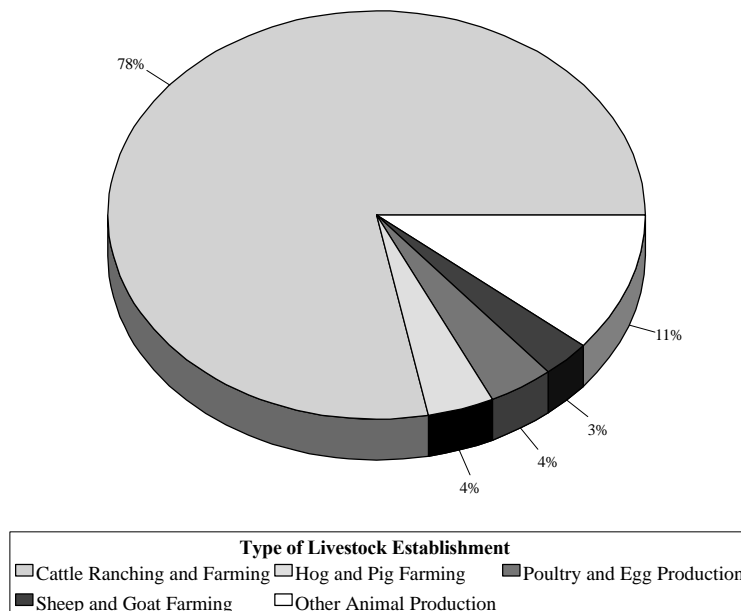
	<b>Turkeys</b>	<b>Broiler Chickens</b>	<b>Egg-laying Chickens</b>
<b>1</b>	North Carolina	Arizona	<i>Ohio</i>
<b>2</b>	Minnesota	Georgia	California
<b>3</b>	Arizona	Alabama	Pennsylvania
<b>4</b>	Virginia	North Carolina	<i>Indiana</i>
<b>5</b>	California	Mississippi	Iowa
<b>7</b>	<i>Indiana</i>		
<b>9</b>			<i>Minnesota</i>

Source: USDA-National Agricultural Statistics Service (NASS), January, 1998

Animal agriculture has changed significantly since existing regulations were enacted. Congress declared CAFOs as point sources in the Federal Water Pollution Control Act Amendments of 1972. Since then, factors such as higher concentrations of animals at feeding operations, the availability of new waste and runoff controls, and increasing public concern regarding water pollution problems have raised awareness that more should be done to control agricultural wastes.<sup>6</sup> A trend

toward consolidation in which fewer and larger operations replace smaller operations has resulted in more nutrients being concentrated over smaller geographic areas.<sup>7</sup>

**Figure 2. Breakdown of Livestock Establishments in the United States<sup>8</sup>**

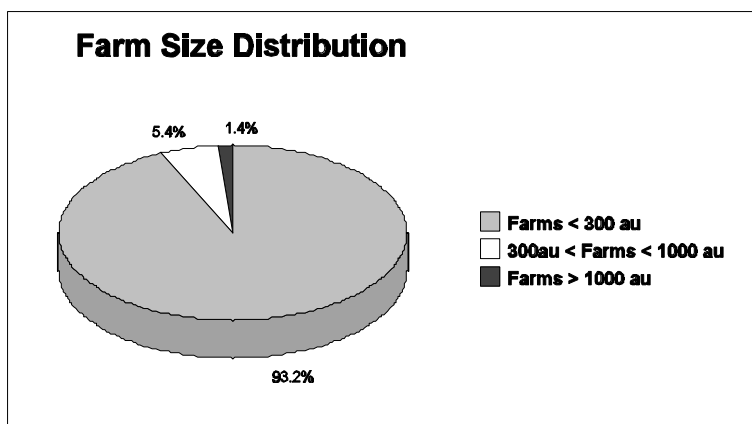


## What is the effect of animal agriculture on surface water quality in Region 5?

### Farm Size in Region 5

About 93 percent of the farms in Region 5 are in the smallest NPDES size class (farms with less than 300 animal units). Large farms (farms with 1,000 or more animal units) only comprise an estimated 1.4 percent of the Region's livestock and poultry farms (Figure 3). Wisconsin has the most livestock and poultry farms in the region (46,511 farms), while Michigan has the least (25,125 farms). Minnesota has the largest percentage of large farms in the region with an estimated 990 farms, while Illinois, Indiana, Michigan, Ohio, and Wisconsin have an estimated 517, 573, 266, 345, and 433 large farms, respectively (Figure 4).

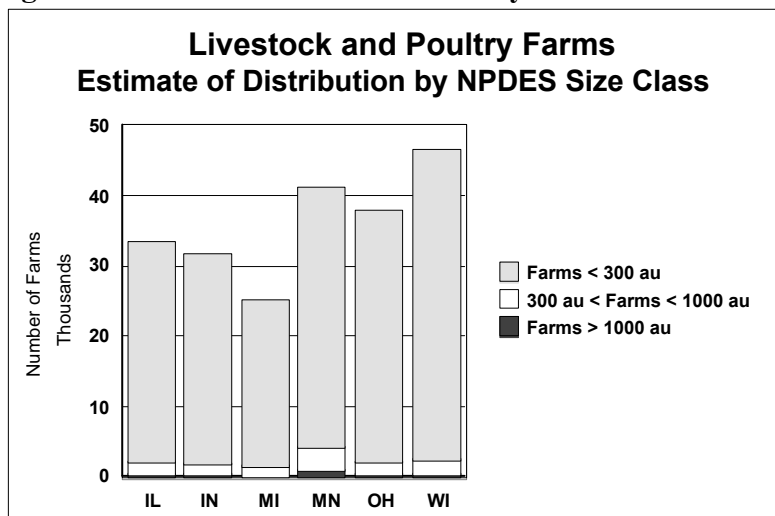
**Figure 3. Distribution of Farm Sizes in Region 5 by NPDES Size Class <sup>+</sup> <sup>■</sup>**



<sup>+</sup> Note: Some small farms may not be AFOs.

<sup>■</sup> Estimates derived from 1997 Census of Agriculture data. Methods/Assumption for determining farm size are located in Appendix A. Estimates are conservatively high.

**Figure 4. Breakdown of Farm Sizes by State <sup>+</sup> <sup>■</sup>**



<sup>+</sup> Note: Some small farms may not be AFOs.

<sup>■</sup> Estimates derived from 1997 Census of Agriculture data. Methods/Assumption for determining farm size are located in Appendix A. Estimates are conservatively high.

## Rivers/Streams

Table 5 shows the number of river and stream miles located in each state of Region 5, as well as the length of the rivers/streams surveyed. This table also shows the length of river and stream miles that are reportedly affected by animal feedlots. In 1996, Minnesota reported that 95.9 percent of all surveyed river and stream miles were affected by animal feedlots, whereas only 0.3, 1.2, 1.5,



and 3.8 percent of river and stream miles located in Michigan, Ohio, Illinois, and Wisconsin were reported to be impaired by animal feedlots, respectively.<sup>9</sup> While these data may indicate distinct differences between Region 5 states with respect to the effect of AFOs/CAFOs on surface water quality, it is likely that the data also reflect that states use different monitoring assessment and reporting techniques for determining the effects of AFOs on water quality. This discrepancy raises concern about the reliability and comparability of each states' sampling methods and monitoring strategies.

**Table 5. Length of Stream and Rivers Surveyed and Impaired by Animal Feedlots<sup>\*9</sup>**

	<b>Total Miles of Rivers/Streams</b>	<b>Total Miles Surveyed</b>	<b>Percentage Surveyed</b>	<b>Miles Impaired by Feedlots<sup>+</sup></b>	<b>Percentage of Surveyed Rivers/Streams Affected by Feedlots</b>
<b>Illinois</b>	87,110	28,454	33	425	1.5
<b>Indiana</b>	35,673	8,355	23	NS	NS
<b>Michigan</b>	51,438	20,575	40	63	0.3
<b>Minnesota</b>	91,944	7,793	8	7,474	95.9
<b>Ohio</b>	29,113	6,560	23	80	1.2
<b>Wisconsin</b>	57,698	19,898	34	765	3.8

*Water Quality Report to Congress, 1996*

<sup>+</sup>Includes feedlots, animal operations, and animal holding/management areas

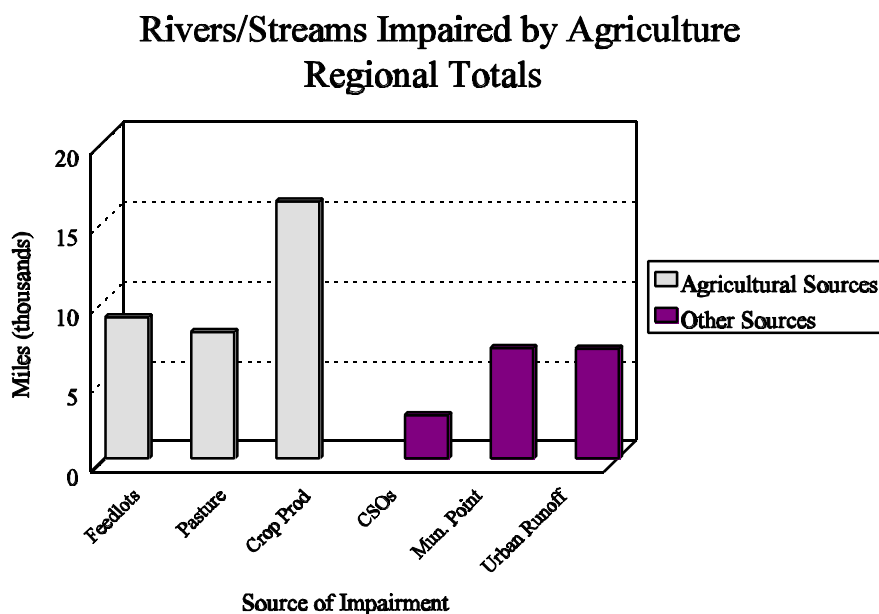
NS - data not specified

Figure 5 shows a comparison between different sources of impairments that affect surface water quality.\* In Region 5, more impairments for assessed waters are caused from agricultural sources than other sources such as combined sewer overflows (CSOs), municipal point sources, and urban runoff. Of the rivers/streams affected by agriculture, the largest source of impairment is due to crop production (16,080 miles), followed by animal feedlots (8,807 miles), and then pasture (7,885 miles).<sup>9</sup>

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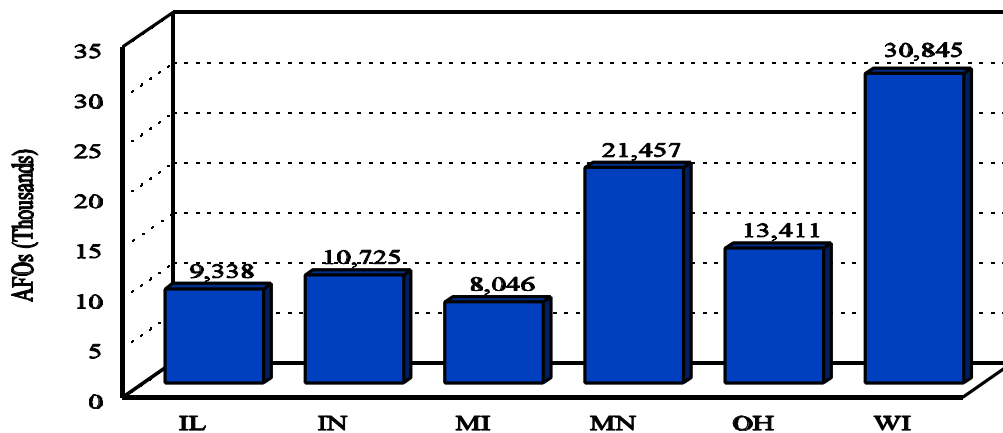
\* The assessed or surveyed water data reported in the *National Water Quality Report to Congress* are a subset of the Nation's total waters. The summary information derived from these surveyed waters may not represent general conditions in the Nation's total waters because many states, tribes, and other jurisdictions often focus on major waters with suspected problems in order to direct resources to areas that could pose the greatest risk. None of the data reported in the *National Water Quality Report to Congress* predict the health of the unassessed waters.

**Figure 5. Sources of Impairment to Rivers/Streams in Region 5 <sup>9</sup>**



The 1997 USDA Agricultural Census accounts for 1,009,487 establishments that produce livestock based on the NAICSC. Together, these livestock establishments occupy 530 million acres of land. Approximately 21 percent of the 450,000 AFOs in the United States exist in Region 5.<sup>6</sup> According to the USDA, Wisconsin has the most AFOs in the region with 30,845 facilities, followed by Minnesota (21,457), Ohio (13,411), Indiana (10,725), Illinois (9,388), and Michigan (8,046) (Figure 6).<sup>10</sup>

**Figure 6. Distribution of Livestock Establishments in Region 5 <sup>8</sup>**



In Region 5, five out of the six states reported the length of river/stream miles that are affected by feedlots (Table 6). Indiana is the only state in Region 5 that did not report impairment of rivers and streams from feedlots. Of the 19 states that reported impairment from feedlots, the states in Region 5 reported 21 percent of the total impairment.\*<sup>9</sup>

**Table 6. Region 5 to Nation comparisons\*<sup>9</sup>**

	<b>Region 5</b>	<b>Nation</b>	<b>Percent in Region 5</b>
<b>River/Stream Miles</b>	352,976	3,634,152	9.7
<b>Surveyed Miles</b>	91,635	686,870	13.3
<b>Miles impaired by feedlots<sup>+</sup></b>	8,807	42,505	20.7
<b>Number of states not reporting feedlot information</b>	1 <sup>++</sup>	31	----

*Water Quality Report to Congress, 1996*

+ Includes feedlots, animal operations, and animal holding/management areas

++ Indiana is the only state in Region 5 that did not report river/stream impairment due to animal feedlots.

### **Inland Lakes, Reservoirs, and Ponds**

As can be seen in Table 7, there is a larger percentage of inland lakes surveyed than rivers. Three states, Illinois, Indiana, and Ohio, do not have specified data regarding the extent of impairment caused by feedlots. Michigan, Minnesota, and Wisconsin reported lower percentages of lakes impaired by animal feedlots than accounted for by the river/stream data. Once again, Minnesota reported the largest amount of impairment caused by animal feedlots (22 percent), while Michigan and Wisconsin reported 0.01 and 0.27 percent, respectively.<sup>9</sup>

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**Table 7. Acres of Lakes, Reservoirs, and Ponds Surveyed and Impaired by Animal Feedlots<sup>+</sup>**

	<b>Total Acres of Lakes, Reservoirs, and Ponds</b>	<b>Total Acres Surveyed</b>	<b>Percentage Surveyed</b>	<b>Acres Impaired by Feedlots</b>	<b>Percentage of Impaired Lakes Affected by Feedlots</b>
<b>Illinois</b>	309,340	188,243	61	NS	NS
<b>Indiana</b>	142,871	106,203	74	NS	NS
<b>Michigan</b>	887,019	490,783	55	48	0.01
<b>Minnesota</b>	3,290,101	2,128,269	65	260,000	12.22
<b>Ohio</b>	188,461	76,813	41	NS	NS
<b>Wisconsin</b>	982,155	124,382	13	336	0.27

*Water Quality Report to Congress, 1996*

<sup>+</sup> Includes feedlots, animal operations, and animal holding/management areas

NS - data not specified

## **United States Geological Survey (USGS) National Water-Quality Assessment (NAWQA) Studies:**

### **Water Quality in the Western Lake Michigan Drainages, Wisconsin and Michigan, 1992-95**

A study by the United States Geological Survey (USGS) of the Western Lake Michigan Drainage area (Appendix B) suggests that the use of commercial fertilizers and/or animal manure are sources of elevated nutrient levels in the waters of the basin. Fifty-four percent of the phosphorus inputs were attributable to commercial fertilizers and 42 percent were caused from manure runoff. Nitrate concentrations at the agricultural sites, mixed agricultural sites, and forested areas were double that of the national average for agricultural areas. Sources of nitrogen, such as animal manure, commercial fertilizers, and effluent from sewage-treatment plants stimulate excessive aquatic vegetation in lakes and streams.<sup>10</sup>

Nutrient concentrations in surface waters were also considerably higher during stormwater runoff. “At two agricultural streams in the study area, more phosphorus was carried during storms during June 1993 than during the next 24 months combined.” In the groundwater, nitrate concentrations were among the highest compared to NAWQA sites nationwide in the shallow aquifer area underlain by sand and gravel. Nutrients from agriculture easily infiltrate into the highly permeable surficial deposits compared to the Cambrian-Ordovician drinking-water aquifer and the shallow aquifer overlain by glacial till which have relatively low concentrations of nitrate.<sup>10</sup>

## **Water Quality in the White River Basin, Indiana, 1992-96**

Most of the inputs of nitrate in the White River Basin (Appendix C) are attributable to commercial fertilizer (61%) and farm-animal manure (19%). Nitrate concentrations in surface waters vary seasonally. The highest concentration of nitrate occurs during the non-growing season (November-March) when plants are dormant and not able to uptake nutrients. Also, nitrate can easily runoff when soils are saturated during wet periods. There is an increase in nitrate concentration in June and July when nitrogen-based fertilizer is applied to corn crops. Clifty Creek, an agricultural stream studied, had higher than expected nitrate concentrations which is believed to be caused from animal wastes. There are more farms animals in the counties that drain into Clifty Creek than the other watersheds studied. High levels of nutrients were expected in the basin from fertilizers and farm-animal waste because of the dominated agricultural land in the basin. One sample from a small agricultural watershed with a high density of farm animals exceeded the aquatic life criterion. Fish communities may also be affected by non-point source pollution such as runoff from hog farms, pesticides in tile-drain effluent, and sedimentation.<sup>11</sup>

Tile drains also influence nitrate concentrations in the streams in the White River Basin. These tiles increase nitrate concentrations by artificially transporting the nitrate-rich shallow ground water into streams. In Sugar Creek, the nitrate concentrations are elevated when tiles are flowing, and drop to background levels in the mid-summer to late fall when the tiles are dry.<sup>11</sup>

## **Groundwater**

No data was reported in the *National Water Quality Inventory 1996 Report to Congress* regarding groundwater.<sup>9</sup>

## **Wetlands**

In Region 5, no quantifiable data were reported in 1996 for impairment of wetlands in Illinois, Indiana, Minnesota, and Ohio. Currently few wetlands are monitored because EPA and states are still working to develop appropriate methods for determining the health of wetlands. Michigan surveyed 10 wetlands, in which all were considered impaired. Metals are the reported source of impairment. Wisconsin's data was not applicable to the National Water Quality Inventory format. However, Wisconsin reported that the following factors contribute to degrading wetland integrity: habitat alterations, filling and draining, metals, salinity/total suspended solids/chlorides, weeds, agriculture, hydrologic modification, urban runoff, filling and draining, construction, recreation, landfills, road construction, development (general), commercial development, residential development

and urban growth, agriculture, road/highway/bridge construction, industrial development, filling and/or dredging, construction (general), utilities, and land disposal.<sup>9</sup>

## Great Lakes

In 1996, all Region 5 states, with the exception of Minnesota, reported that 100 percent of the Great Lakes shoreline miles were surveyed. Indiana, Michigan, Minnesota, Ohio, and Wisconsin reported 100 percent of the shoreline miles as impaired, while Illinois reported zero percent of the shoreline miles as impaired (Table 8). Much of the data for the cause of impairment was not reported in a quantifiable format or is unknown. Wisconsin attributes much of the impairment to the Great Lakes shoreline to nutrients, oxygen-depleting substances, and bacteria (Table 8). Wisconsin also suggests that agriculture is the source of impairment for 120 miles of the Great Lakes shore, while unspecified NPS pollution is responsible for 210 miles of impairment (Table 9).<sup>9</sup>

**Table 8. Total Miles of Impaired Great Lakes Shoreline<sup>+9</sup>**

	<b>Total Miles</b>	<b>Miles Surveyed</b>	<b>Percent Surveyed</b>	<b>Miles Impaired</b>	<b>Percent Impaired</b>
<b>IL</b>	63	63	100	0	0
<b>IN</b>	43	43	100	43	100
<b>MI</b>	3,250	3,250	100	3,250	100
<b>MN</b>	272	-	-	-	-
<b>OH</b>	236	236	100	236	100
<b>WI</b>	1,017	1,017	100	1,017	100

*Water Quality Report to Congress, 1996*

<sup>+</sup>Note: Impairment is not caused by AFOs

**Table 9. Total Great Lakes shoreline miles impaired by selected pollutants <sup>+9</sup>**

	Nutrients	Oxygen-Depleting Substances	Bacteria	Siltation	Noxious Aquatic Plants	Suspended Solids	Ammonia
<b>IL</b>	-	-	-	-	-	-	-
<b>IN</b>	-	-	-	-	-	-	-
<b>MI</b>	-	-	1	-	1	-	-
<b>MN</b>	-	-	-	-	-	-	-
<b>OH</b>	35	46	-	-	-	-	-
<b>WI</b>	175	175	120	75	75	20	20

*Water Quality Report to Congress, 1996*

<sup>+</sup>Includes major and moderate/minor sources of impairment

**Table 10. Total<sup>+</sup> miles that agriculture and unspecified NPS pollution has on the impairment of Great Lakes shoreline miles <sup>9</sup>**

	Agriculture	Unspecified NPS
<b>IL</b>	-	-
<b>IN</b>	-	-
<b>MI</b>	-	-
<b>MN</b>	-	-
<b>OH</b>	-	86
<b>WI</b>	120	210

*Water Quality Report to Congress, 1996*

<sup>+</sup>Includes major and moderate/minor sources of impairment

**Table 12. Miles of Drinking Water Supply Use Support in the Great Lakes <sup>9</sup>**

	Full Support	Threatened	Partially Supporting	Not Supporting
<b>IL</b>	63	0	0	0
<b>IN</b>	43	0	0	0
<b>MI</b>	3,170	-	-	80
<b>MN</b>	-	-	-	-
<b>OH</b>	-	-	-	-
<b>WI</b>	977	20	20	0

*Water Quality Report to Congress, 1996*

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